Remarks

Claims 11 – 16 stand rejected under 35 USC §112, first paragraph. The rejection states that there is no support for the "less than 10 μm" language. Although the Applicants disagree because the 10 μm upper limit is within the originally disclosed 1.1 to 12 range, the Applicants have, nonetheless, amended Claims 11 and 14 to recite a range of 1.1 μm to 8.6 μm. As was the case before, 8.6 is within the original range of 1.1 to 12. However, the Applicants invite the Examiner's attention to Table 6, Example 49 which recites a diameter of 8.6 μm. Withdrawal of the rejection is respectfully requested.

Claims 1 – 3 and 6 – 8 stand rejected under 35 USC §103 over Yoshinaga. The Applicants note with appreciation the Examiner's detailed comments hypothetically applying Yoshinaga against those claims. The Applicants, nonetheless, respectfully submit that Yoshinaga is inapplicable to those claims under §103. Details and reasons are set forth below.

The rejection relies on several arguments in support of the obviousness rejection. A primary reason is inherency. In particular, the Applicants claimed fatigue endurance after quenching 450 mpa or more is said to be inherent. That rejection also states on Page 9 "that once the Examiner has presented a case inherency, the burden is on Applicants to show an unobvious difference." The Applicants respectfully submit that this is not the standard for application of inherency. The Applicants respectfully submit that a mere allegation of inherency in support of a rejection under §102 and/or §103 is not sufficient to support the rejection. In other words, the mere assertion of inherency does not shift the burden to the Applicants. The rejection based on inherency must meet a threshold test. That test is that facts must be presented to support the position and those facts need to demonstrate that the allegedly inherent physical characteristic are "necessarily" present based on the disclosure of the particular prior art reference upon which the rejection is based. In that regard, it is not enough that the physical characteristic might be present, could be present or is even likely present, it "must necessarily" be present.

In this instance, the rejection states that there are overlaps in composition and in methodology sufficient to assert inherency. While the rejection provides details as to the overlapping composition, there is no discussion of similarities of methodology. Those skilled in the art know that the methods in which steel is made has as much to do with the final physical characteristics as the components

comprising the steel. Nonetheless, that issue is not factually addressed in the rejection. Thus, the Applicants respectfully submit that the assertion of inherency is insufficient to need the threshold test that the Applicants claimed characteristic with respect to fatigue endurance would "necessarily" be present. Thus, the Applicants respectfully submit that there is no burden upon the Applicants to show a lack of inherency.

Nonetheless, the Applicants have already done that. In that regard, the Applicants again invite the Examiner's attention to Tables 4 and 6 which contain examples and comparative examples having ferrite grains within the claimed range and also within the range disclosed by Yoshinaga. Moreover, those tables contain corresponding fatigue endurance numbers.

The Applicants, thus, invite the Examiner's attention to Comparative Examples 5, 9, 24, 26, 28, 30, 31 and 36, all of which have ferrite grain diameters that are within the range disclosed by Yoshinaga. Those diameters are 15.6, 13.4, 12.9, 13.2, 14.3, 15.2, 13.5 and 16.9, respectively. The corresponding fatigue endurance values are 420, 365, 388, 388, 442, 436, 426 and 398, respectively. In every instance, the examples of steels having a grain diameter within the range disclosed by Yoshinaga and outside the range claimed by the Applicants in Claims 1 – 3 and 6 – 8 have fatigue endurance less than the claimed 450 mpa or more.

Thus, despite alleged overlap in constitutional elements comprising the composition of the steels of Yoshinaga and the Applicants' claimed steels and despite an alleged similarity in methodology, the Applicants have <u>factually</u> demonstrated that steels having compositions similar to those Yoshinaga and ferrite claim diameters similar to those taught by Yoshinaga have fatigue endurance values that are outside of the Applicants' claimed language.

It must be remembered that the examples and comparative examples presented in the Applicants' Specification and the results shown in Tables 4 and 6 were actually conducted and submitted under oath by the Applicants. This is sharply contrasted to the rejection which merely asserts that the claimed physical characteristic would inherently be present. Again, the Applicants have factually demonstrated that real life steel examples having ferrite grain diameters within the range of those taught by Yoshinaga have fatigue endurance values that are outside of the Applicants' claimed range. The Applicants respectfully submit that this is compelling factual evidence demonstrating that the Applicants' claimed fatigue endurance is not inherently the same as those taught by Yoshinaga.

This is important because inherency must be demonstrated by showing that the claimed physical characteristic would "necessarily" be present in the Yoshinaga steels. The Applicants, in fact, demonstrated that they would likely not be the same. It is also important to remember that the burden of them proving inherency is quite strict because of the "necessarily" requirement. The Applicants need only introduce doubt as those physical characteristics being present in the Yoshinaga steels to successfully overcome the assertion of inherency. All the Applicants need to show is that the claimed physical characteristic is not "necessarily" present. The Applicants have more than done that by their factual demonstration based on steels having overlapping compositions with grain diameters within the range taught by Yoshinaga --- yet those steels have a different fatigue endurance. As a result, the Applicants respectfully submit that the inherency burden cannot be met and that the rejection of Claims 1 – 3 and 6 – 8 cannot be sustained. Withdrawal of the rejection is respectfully requested.

Claims 11 – 16 stand rejected under 35 USC §103 over Yoshinaga. The Applicants again note with appreciation the Examiner's detailed comments hypothetically applying Yoshinaga against those claims. Nonetheless, the Applicants respectfully submit that Yoshinaga fails to provide disclosures, teachings or suggestions that would lead one skilled in the art toward the subject matter of those claims. Details are provided below.

The Applicants' Claims 11 – 16 recite that the steel structures have a ferrite grain diameter of 1.1 to 8.6 μm. Yoshinaga teaches away from that range. Such teachings may be found in Col. 12 at Lines 62 – 64. That language is reproduced below for the Examiner's convenience as follows:

> The average crystal grain size of the ferrite is 10 μm or larger. When it is less than 10 μm, it becomes difficult to secure good ductility.

These teachings are quite clear. They specifically tell those skilled in the art to make sure that the crystal grain size of the ferrite is at least 10 μm. There is utterly no suggestion that the crystal grain size of the ferrite be less than 10 μm. In fact, Yoshinaga cautions against a crystal grain size of the ferrite being less than 10 μm.

Those teachings are reinforced in the many examples of Yoshinaga wherein comparative examples having grain diameters less than 10 μm are specifically labeled as "out of scope of invention." In that regard, the Applicants invite the Examiner's attention to Col. 29 and 30, Table 8

at steel grades F and H wherein two (2) comparative examples have average crystal grain sizes of 9 and 7 μm. It should be noted that the average crystal grain size of 9 is specifically labeled as "out of scope of invention." This is sharply contrasted to the Applicants' claimed range of 1.1 to 8.6 in Claims 11 – 16. Thus, Yoshinaga characterizes a steel having an average crystal grain size of the ferrite of 9 μm as not being acceptable and outside of the scope of their invention. One skilled in the art would surely not reduce the average crystal grain size of the ferrite to an even lower amount as recited in Claims 11 – 16 in view of such teachings by Yoshinaga.

The Applicants, therefore, respectfully submit that Yoshinaga leads those skilled in the art away from the subject matter of Claims 11 – 16. Of course, it is well settled that prior art leading those skilled in the art in the opposite direction taken by a patent applicant is compelling evidence of patentability.

Claims 11-16 are also rejected under 35 USC §103 over Hasegawa. The Applicants respectfully submit that Hasegawa is also inapplicable, as is Yoshinaga, for the following reasons.

It is important in Claims 1, 6, 11 and 14 to control, in an appropriate range, the range of Ceq and the total X of multiplying factors of quenching by Grossman, in addition to the range of chemical composition of the respective elements.

On the other hand, as seen in attached Table 2 (a Comparison Table of the Applicants' subject matter, Yoshinaga and Hasegawa), in Yoshinaga and Hasegawa, there is no disclosure concerning (b) carbon equivalent Ceq and (c) total X of multiplying factors of quenching by Grossman.

To factually demonstrate the foregoing, in attached Table 1-1 and Table 1-2, there were made calculations of Ceq and X factor of the component of 33 Examples of Yoshinaga and the component of 13 Examples of Hasegawa. However, there were no Examples that satisfy the range specified in Claims 1, 6, 11 and 14. The columns in yellow show values which are out of the range of Claims 1, 6, 11 and 14.

In particular, the C contents of most of the Examples, except an Example No. G in Table 1 of Examples of Yoshinaga and Example No. 13 in Table 1 of Examples of Hasegawa, are outside the range. Also, Ceq of the examples, except two examples, namely No. G in Table 1 and No. M in Table 6 of Examples of Yoshinaga, are out of the range. Also, Examples of Hasegawa are outside the range, except Examples Nos. 6 to 9, 11 and 13 of Table 1.

Moreover, the total X of multiplying factors of quenching by Grossman of Examples is outside the range, except an Example No. F in Table 6 of Yoshinaga and Examples Nos. 5 to 7, 9, and 10 in Table 1 of Hasegawa.

As set forth in the Applicants' Specification on page 7 in paragraph No. [0023], the C content is an element necessary for securing fatigue endurance after quenching. However, at a C content of less than 0.18%, it is difficult to secure the desired fatigue endurance, while at a C content exceeding 0.29%, resistance for hydrogen embrittlement degrades.

In addition, concerning Ceq, as set forth in the Applicants Specification on page 13 in paragraph No. [0044], when the Ceq is less than 0.4, the desired hardening penetration and fatigue endurance cannot be obtained. On the other hand, when the Ceq is 0.58 or more, resistance for hydrogen embrittlement after quenching and low temperature toughness degrade.

Pertaining to the total X of multiplying factors of quenching, as set forth in the Applicants' Specification on page 14 in paragraph Nos. [0049] and [0050], when the X is less than 1.2, hardness after quenching decreases and it is, thus, impossible to obtain excellent fatigue endurance after quenching, e.g., a maximum stress amplitude σ f of 450 MPa or more without fatigue failure in the completely reversed plane bending fatigue test. On the other hand, when the X is 1.7 or more, the ferrite volume fraction of steel is less than 30%, the formability of an original sheet decreases, and a portion where the thickness is locally decreased becomes a stress concentration portion, thereby failing to achieve excellent fatigue endurance, e.g., an σ f of 450 MPa or more after quenching.

When the foregoing is considered, the Applicants' respectfully submit that Claims 1,6 and 11-14 are not obvious over Yoshinaga or Hasegawa.

It is understood when 6 points, namely three Examples Nos. 24, 26 and 9 (σ f=388, 388, 365 MPa) in existence in the smaller side and outside of the Applicants' range in grain size and three Examples Nos. 49, 42 and 6 (σ f=513, 510, 488) in existence in the larger side and inside of the Applicants' range in grain size, are plotted and regression analysis is conducted, the boundary of grain size satisfying σ f >450 MPa is less than 10 μm. (cf. attached Fig. 1). This claimed range is enhanced by the fact that Claims 11-16 recite a range of 1.1 to 8.6.

Yoshinaga teaches from column 12 at line 62 to column 3 at line 3, "The average crystal grain size of the ferrite is 10 μm or larger, preferably 20 μm or larger, more preferably 30 μm or larger." These ranges do not overlap with the crystal grain size defined in Claims 11 and 14.

Also, as shown in attached Table 2, although the range in itself of crystal grain size of the ferrite of Hasegawa overlaps, Claims 1, 6, 11 and 14 specify the texture before cooling by water ("quench"... is affirmatively recited) to be conducted after heating in an austenite range whereas, Hasegawa specifies the texture before slow cooling (Cooling rate 0.1 to 100°C/s) to be conducted after heating in a two-phase range. Hence, the processes of heating are dissimilar. The reason for the differences is that Hasegawa relates to a plate for use in marine structural members which is different from steel pipe to be used for automobile structural members.

The Applicants therefore respectfully submit that both of Hasegawa and Yoshinaga are inapplicable to Claims 11-16. Withdrawal of the rejections is respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,

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No.	df	σf
9	13.4	365
24	12.9	388
26	13.2	388
6	8.2	488
42	8.4	510
49	8.6	513

Fig. 1

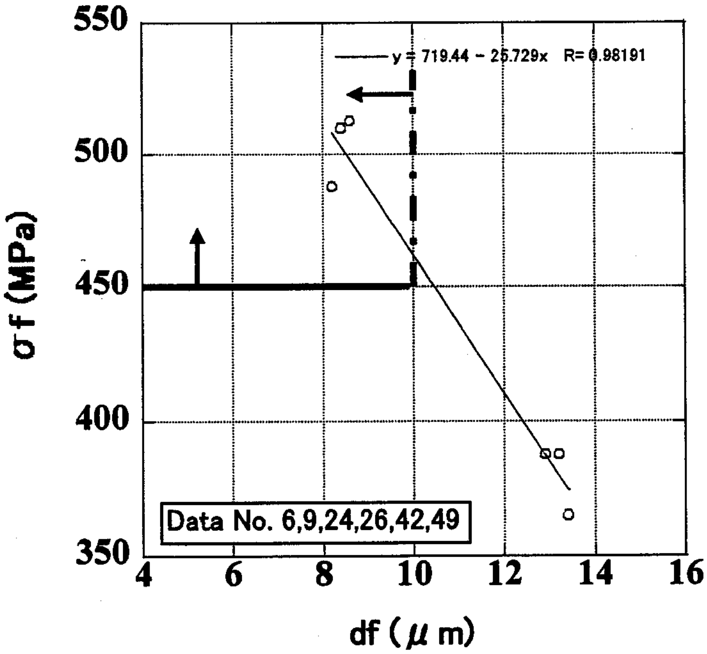

Table 1-1

		Steel	C	Si	Mn	P	S	Sol.Al	N	B	Nb	Ti	Cr	Mo	Ni	Cu	V	Sn	Ca	Ceq.	Remark
		min	0.18	0.06	0.91			0.015		0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.0001	0.40	
		max	0.29	0.45	1.85	0.019	0.0029	0.075	0.0049	0.0029	0.019	0.029	0.195	0.195	0.145	0.175	0.029		0.0029	0.58未満	
			Chemical Composition (wt. %)																		
		Steel	C	Si	Mn	P	S	Sol.Al	N	B	Nb	Ti	Cr	Mo	Ni	Cu	V	Sn	Ca	Ceq.	Remark
US6632296 Yoshinaga	Table1	A	0.0025	0.01	1.12	0.065	0.005	0.050	0.0019	0.0003	0.016	0.022								0.19	×
		B	0.018	0.02	0.12	0.022	0.004	0.015	0.0020											0.04	×
		C	0.045	0.01	0.25	0.008	0.003	0.022	0.0025	0.0019										0.09	×
		D	0.083	0.12	0.41	0.015	0.005	0.016	0.0025									0.02		0.16	×
		E	0.088	0.01	0.82	0.022	0.003	0.050	0.0033		0.020									0.23	×
		F	0.125	0.01	0.45	0.010	0.009	0.036	0.0024											0.20	×
		G	0.281	0.20	1.01	0.024	0.003	0.031	0.0023	0.0000	0.000	0.000	0.10	0.000						0.48	×
	Table4	A	0.0025	0.01	1.25	0.065	0.005	0.042	0.0019	0.0005	0.015	0.016								0.21	×
		B	0.0021	0.01	0.12	0.008	0.004	0.045	0.0024			0.022								0.02	×
		C	0.017	0.02	0.11	0.008	0.004	0.043	0.0020		0.035							0.02		0.04	×
		D	0.018	0.01	0.15	0.065	0.006	0.052	0.0018											0.04	×
		E	0.045	0.01	0.29	0.005	0.006	0.016	0.0025	0.0005	0.042		0.15							0.12	×
		F	0.043	0.03	0.25	0.004	0.004	0.015	0.0026			0.015								0.09	×
		G	0.079	0.08	0.94	0.016	0.006	0.025	0.0029		0.058	0.012								0.24	×
		H	0.083	0.04	0.14	0.015	0.005	0.041	0.0030	0.0002	0.010									0.11	×
		I	0.125	0.03	1.16	0.006	0.002	0.045	0.0018											0.32	×
		J	0.121	0.03	0.36	0.006	0.003	0.050	0.0023											0.18	×
		K	0.0031	0.30	0.54	0.048	0.008	0.044	0.0025		0.015	0.019					0.023			0.11	×
		L	0.038	0.12	0.35	0.006	0.004	0.016	0.0023		0.014	0.021		0.15						0.14	×
		M	0.053	1.20	1.19	0.004	0.002	0.025	0.0019										0.002	0.30	×
	Table6	A	0.0022	0.68	0.12	0.112	0.005	0.044	0.0019	0.0005		0.053						0.02		0.05	×
		B	0.0021	0.01	0.09	0.005	0.004	0.042	0.0022		0.015	0.019								0.02	×
		C	0.0016	0.35	0.64	0.070	0.004	0.256	0.0023	0.0009	0.024									0.12	×
		D	0.016	0.02	0.11	0.069	0.003	0.510	0.0020					0.12						0.07	×
		E	0.018	0.03	0.26	0.011	0.006	0.053	0.0018											0.06	×
		F	0.051	2.03	1.23	0.026	0.002	0.146	0.0025	0.0002		0.045	0.18							0.38	×
		G	0.045	0.03	0.25	0.004	0.004	0.015	0.0017	0.0026										0.09	×
		H	0.069	0.04	0.92	0.006	0.001	0.031	0.0027		0.047	0.009							0.002	0.22	×
		I	0.064	0.01	1.05	0.015	0.003	1.343	0.0031		0.060									0.24	×
		J	0.118	0.64	1.30	0.012	0.002	0.046	0.0020				0.10		0.11	0.23				0.38	×
		K	0.122	1.78	0.25	0.026	0.003	0.066	0.0025						0.09		0.017			0.24	×
		L	0.167	0.67	0.51	0.021	0.005	0.519	0.0022		0.015									0.28	×
		M	0.165	0.04	1.40	0.007	0.004	0.019	0.0026	0.0000	0.000	0.000	0.000	0.000						0.40	×
JP2002-266022A Hasegawa	Table 1	1	0.16	0.31	1.02	0.010	0.003	0.031	0.0035			0.008								0.34	×
		2	0.12	0.25	1.44	0.009	0.002	0.036	0.0029								0.095			0.38	×
		3	0.10	0.25	1.52	0.010	0.003	0.018	0.0028		0.008									0.36	×
		4	0.08	0.16	1.48	0.008	0.001	0.030	0.0033		0.012	0.011			0.24	0.25	0.041			0.34	×
		5	0.06	0.31	1.54	0.010	0.002	0.047	0.0040	0.0009		0.015			0.53	0.51				0.34	×
		6	0.08	0.27	0.97	0.008	0.001	0.058	0.0031	0.0011			0.55	0.41		0.25	0.077		0.001	0.47	×
		7	0.10	0.27	0.95	0.009	0.002	0.056	0.0040	0.0010	0.009		0.51	0.45	0.55	0.24	0.040			0.50	×
		8	0.09	0.16	0.75	0.008	0.003	0.075	0.0036	0.0011	0.015	0.009	0.75	0.51	2.88	0.28				0.57	×
		9	0.02	0.27	1.73	0.006	0.001	0.044	0.0027	0.0015		0.010	0.26	0.21	0.58	0.26			0.001	0.44	×
		10	0.06	0.09	0.67	0.008	0.001	0.015	0.0028		0.006	0.006	0.25	0.19	0.20	0.21	0.075		0.001	0.28	×
		11	0.31	0.33	0.66	0.012	0.003	0.026	0.0025								0.046			0.44	×
		12	0.10	0.42	3.11	0.009	0.003	0.034	0.0041		0.005	0.011								0.64	×
		13	0.18	0.28	1.46	0.012	0.003	0.035	0.0033	0.0000	0.000	0.000	0.000	0.000						0.44	×

Table1－2

		Steel	Grossman χ factor of each element: C	Si	Mn	P	S	Sol.Al	N	B	Nb	Ti	Cr	Mo	Ni	Cu	V	Sn	Ca	Total Grossman χ factor	Remark
US6632296 Yoshinaga	Table1	A	0.000	0.00	0.68	0.065		0.028		0.2000		−0.018								0.95	×
		B	0.000	0.01	0.15	0.022		0.012												0.19	×
		C	0.000	0.00	0.26	0.008		0.012		0.0000										0.29	×
		D	0.000	0.04	0.37	0.015		0.012												0.44	×
		E	0.005	0.00	0.57	0.022		0.028												0.63	×
		F	0.088	0.00	0.40	0.010		0.022												0.52	×
		G	0.259	0.06	0.64	0.024		0.017					0.09							1.08	×
	Table4	A	0.000	0.00	0.72	0.065		0.022		0.2000		−0.018								0.99	×
		B	0.000	0.00	0.15	0.008		0.028				−0.018								0.17	×
		C	0.000	0.01	0.14	0.008		0.022												0.17	×
		D	0.000	0.00	0.18	0.065		0.028												0.27	×
		E	0.000	0.00	0.29	0.005		0.012		0.0000			0.12							0.44	×
		F	0.000	0.01	0.26	0.004		0.012				−0.018								0.27	×
		G	0.000	0.02	0.62	0.016		0.017				−0.008								0.67	×
		H	0.000	0.01	0.17	0.015		0.022		0.0000										0.22	×
		I	0.088	0.01	0.69	0.006		0.028												0.82	×
		J	0.071	0.01	0.34	0.006		0.028												0.46	×
		K	0.000	0.08	0.45	0.048		0.022				−0.018					0.097			0.68	×
		L	0.000	0.04	0.34	0.006		0.012				−0.018		0.16						0.53	×
		M	0.000	0.27	0.70	0.004		0.017												0.98	×
	Table6	A	0.000	0.17	0.15	0.112		0.022		0.2000		−0.043								0.61	×
		B	0.000	0.00	0.11	0.005		0.022				−0.018								0.13	×
		C	0.000	0.10	0.50	0.070		*0.080*		0.0000										0.74	×
		D	0.000	0.01	0.14	0.069		*0.080*						0.13						0.43	×
		E	0.000	0.01	0.27	0.011		0.028												0.32	×
		F	0.000	0.38	0.71	0.026		*0.080*		0.2000		−0.043	0.14							1.50	○
		G	0.000	0.01	0.26	0.004		0.012		0.2000										0.49	×
		H	0.000	0.01	0.61	0.006		0.017				−0.008								0.64	×
		I	0.000	0.00	0.65	0.015		*0.080*												0.75	×
		J	0.071	0.16	0.74	0.012		0.028					0.09		0.02					1.12	×
		K	0.071	0.35	0.26	0.026		0.039							0.01		0.097			0.86	×
		L	0.146	0.17	0.43	0.021		*0.080*												0.85	×
		M	0.146	0.01	0.78	0.007		0.012												0.96	×
JP2002-266022A Hasegawa	Table 1	1	0.133	0.09	0.64	0.010		0.017				−0.008								0.88	×
		2	0.071	0.07	0.79	0.009		0.022									0.097			1.06	×
		3	0.029	0.07	0.82	0.010		0.012												0.94	×
		4	0.000	0.05	0.81	0.008		0.017				−0.008			0.04		0.146			1.05	×
		5	0.000	0.09	0.83	0.010		0.028		0.2000		−0.018			0.08					1.21	○
		6	0.000	0.08	0.63	0.008		0.033		0.0000			0.34	0.35			0.124			1.56	○
		7	0.029	0.08	0.62	0.009		0.033		0.0000			0.32	0.37	0.08		0.146			1.69	○
		8	0.005	0.05	0.54	0.008		0.044		0.2000		−0.008	0.42	0.40	*0.13*					1.79	×
		9	0.000	0.08	0.89	0.006		0.022		0.2000		−0.008	0.19	0.21	0.08					1.67	○
		10	0.000	0.03	0.51	0.008		0.012				−0.008	0.19	0.20	0.30		0.124			1.36	○
		11	0.274	0.09	0.51	0.012		0.017									0.146			1.04	×
		12	0.029	0.11	*1.00*	0.009		0.017				−0.008								1.16	×
		13	0.158	0.08	0.80	0.012		0.022												1.07	×

Table 2

Item	US6632296B2(Yoshinaga)	JP2002-266022A(Hasegawa)	2004S01144US
Field	Texture controlled tube with excellent hydro-formability	Thick Hot Plate for offshore structure, pressure vessel, shipbuilding, bridge, construction and pipe line	Steel for automobile structural parts having excellent formability, **fatigue endurance after quenching (>450MPa), low temperature toughness and resistance for hydrogen embrittlement**
(a) Carbon content	0.0001 to 0.50 wt.%	0.01 to 0.2.%	0.18 to 0.29.%
(b) Carbon equivalent	Undescribed	Undescribed	**0.4 to 0.58**
(c) Grosmann χ factor	Undescribed	Undescribed	**1.2 to 1.7**
(a) and (b) and (c)	**None (see Table1-1 & 1-2)**	**None (see Table1-1 & 1-2)**	**Claimed (All cases)**
Ferrite grain diameter (μ m)	$\geqq 10\mu$ m	$1\sim 3\mu$ m before intercritical tempering (Cooling rate 0.1 to 100℃/s)	1.1~<=8.6 μ m **before austenite region reheating and quenching**